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proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

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## PART 1 GENERAL

### 1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text are automatically deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

FM GLOBAL (FM)

FM P7825 (2005) Approval Guide

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2008) Life Safety Code, 2006 Edition

NFPA 70 (2007; AMD 1 2008) National Electrical Code - 2008 Edition

NFPA 72 (2006) National Fire Alarm Code

NFPA 75 (2008) Protection of Information Technology Equipment

NFPA 90A (2008) Standard for the Installation of Air Conditioning and Ventilating Systems

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES  
(NICET)

NICET 1016-2 (2003) Program Detail Manual Fire Alarm  
Systems, 8th Edition

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595 (Rev B; Am 1) Colors Used in Government  
Procurement

UNDERWRITERS LABORATORIES (UL)

UL 1449 (2006) Surge Protective Devices

UL 1480 (2003; Rev thru Dec 2006); Standard for  
Safety Speakers for Fire Alarm, Emergency,  
and Commercial and Professional Use

UL 1711 (1994) UL Standard for Amplifiers for Fire  
Protective Signaling Systems, 3rd Edition

UL 1971 (2002; Rev thru Oct 2008) Signaling  
Devices for the Hearing Impaired

UL 2196 (2001) UL Standard for Tests for Fire  
Resistive Cables, 1st Edition

UL 268 (2006) Standard for Smoke Detectors for  
Fire Alarm Signaling Systems

UL 268A (2008) Smoke Detectors for Duct Application

UL 346 (2005) Waterflow Indicators for Fire  
Protective Signaling Systems

UL 38 (2008; Rev thru Dec 2008) Standard for  
Signaling Boxes for Fire Alarm Systems

UL 464 (2003; Rev thru Feb 2008) Standard for  
Audible Signal Appliances

UL 497B (2004; Rev thru Oct 2008) Protectors for  
Data Communication and Fire Alarm Circuits

UL 521 (1999; Rev thru Jul 2005) Heat Detectors  
for Fire Protective Signaling Systems

UL Fire Prot Dir (2008) Fire Protection Equipment Directory

1.2 SUBMITTALS

\*\*\*\*\*  
NOTE: Review Submittal Description (SD) definitions  
in Section 01 33 00 SUBMITTAL PROCEDURES and edit  
the following list to reflect only the submittals  
required for the project. Keep submittals to the  
minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, use a code of up to three characters within the submittal tags following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

\*\*\*\*\*

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that reviews the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Submit [Evidence of the Contractor's State Certification](#) to the Contracting Officer for approval prior to any work being started on the Preaction System.

Submit fully verified and dated copies of all Fire Alarm Acceptance test data and results with a copy of the approved test procedure and any factory test information.

Provide one (1) copy of the test procedure and recording forms for the preliminary tests. For the final acceptance tests, provide 10 copies of the test procedures and recording forms.

#### SD-02 Shop Drawings

Submit the following for preaction control systems in accordance with the paragraph entitled, "General Requirements."

[Connection Drawings](#)  
[Schematics](#)  
[Module Schematic Drawings](#)  
[As-Built Drawings](#)  
[Revised Programs](#)  
[Preaction System Acceptance Tests](#)

## Fire Service Floor Plans

### SD-03 Product Data

Submit manufacturer's catalog data to the Contracting Officer for approval, prior to any work being started on the preaction system for the following items:

- Preaction Control Panel
- CFMS Reporting Equipment
- Addressable Modules/Devices
- Annunciator Panels
- Heat-Actuated Detectors
- Smoke Detectors
- Duct Smoke Detectors
- Manual Alarm Stations
- Alarm Bells
- Strobe Units
- Speakers
- Fire Resistive Cables
- Water Flow Alarm Devices
- Valve Tamper Switches
- Remote Auxiliary Control Relays
- Power Sources
- Line Voltage Surge Suppressors
- Low Voltage Surge Suppressors
- Wiring

### SD-05 Design Data

#### Design Analysis and Calculations

Submit List of Parts and Components in accordance with the paragraph entitled, "General Requirements," of this section.

\*\*\*\*\*  
NOTE: Coordinate these submittals with Contract  
Schedule Section IV, "Inspection Testing  
Requirements."  
\*\*\*\*\*

### SD-07 Certificates

Submit Quality Assurance Plan consisting of the following, in accordance with the paragraph entitled, "Quality Assurance" of this section.

Submit proof that all components are Underwriter Laboratory (UL Fire Prot Dir) listed or Factory Mutual FM P7825 approved for their intended use and function.

### SD-10 Operation and Maintenance Data

Submit Operation and Maintenance Manuals in accordance with the paragraph entitled, "Execution," of this section.

## 1.3 GENERAL REQUIREMENTS

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**NOTE: Section 26 05 00.00 40 COMMON WORK RESULTS  
FOR ELECTRICAL and Section 26 00 00.00 20 BASIC  
ELECTRICAL MATERIALS AND METHODS must be included in  
the project specifications when this section is used.**

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Section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL and Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS apply to work specified in this section.

Submit [Connection drawings](#) for approval [30][60][90][\_\_\_\_\_] days after Notice to Proceed for installation of the Preaction and Detection System(s). Connection drawings must consist of point-to-point wiring diagrams of internal and external wiring, but not limited to, preaction field devices, panel wiring, and interconnection between other building systems and components.

Submit .DXF or .DWG Format computer generated connection drawings, schematics, As-Built drawings and fire service floor plans.

Submit [Schematics](#) for approval for Preaction and Detection Control Systems consisting of the following:

[Module schematic drawings](#) (minimum size 216 by 280 millimeter 8-1/2 by 11 inches) to be provided prior to system acceptance testing.

Submit [As-Built drawings](#) indicating all field changes for approval 21 days prior to the acceptance testing phase of the project, as described in the paragraph entitled, "Field Testing" of this specification section. Provide magnetic media and hard copies of all new and revised software and drawings with the submittal. As-Built drawings must document final system configuration including, but not limited to, geographic monitor zone boundaries, location of the preaction control panel, all initiating and auxiliary control devices, signaling line devices, notification appliances, additional cabinets, wet and dry pipe sprinkler risers, dry pipe control panel, smoke and fire dampers, magnetic door holders and all other equipment associated with the preaction system(s). Also, annotate the location and address setting for each multiplexed addressable device (when used), deviations from and amendments to the drawings, and field installation changes, concealed and visible.

[Revised programs](#) information (CMS file), both hard copy and disks, for existing Simplex Central Fire Monitoring System. Program information for preaction control panel including program listing, system point summary, and addressable device switch settings must be submitted for approval 21 days prior to the acceptance testing phase of the project, as described in the paragraph entitled, "Field Testing" of this specification section.

Provide Program Logic and/or a Sequence of Operations which clearly shows the interaction of system components.

[Preaction System Acceptance tests](#) must be conducted in accordance with the paragraph entitled, "Field Testing" of this specification section. Prepare a test procedure and test record forms for conducting and recording complete tests on control panels, reporting systems, wiring systems, and field devices installed in accordance with the manufacturer's requirements and these specifications. Submit for approval, the test procedure to the Contracting Officer at least 30 days prior to the preliminary system test described in the paragraph entitled, "Field Testing" of this specification



section. Test procedure must identify each device and circuit to be tested, describe the initial condition, each step or function in the test, required test result, and equipment to be employed. Provide test forms with suitable spaces for recording test results on all equipment, devices, and wiring to be tested. Test record forms must also have identified spaces for verification signatures of official witnesses and dates of the test.

**Fire Service Floor Plans** must indicate location of the preaction control panel, all initiating and auxiliary control devices, signaling line devices, notification appliances, additional cabinets, detection systems, wet and dry pipe sprinkler risers, dry pipe control panel smoke and fire dampers, magnetic door holders and all other equipment associated with the preaction system(s). Also, annotate the location and address setting for each multiplexed addressable device (when used). There are to be no borders or title blocks on the Fire Service Floor Plans. [Coordinate with the requirements of the Preacton System Fire Service Floor Plans such that all preaction and suppression system devices are combined on a single Fire Service Floor Plans.] Provide a symbol legend which clearly identifies each device shown on the Fire Service Floor Plans. Install a copy of the Fire Service Floor Plans minimum size **0.457 by 0.61 meters 18 inches by 24 inches** in a painted metal frame with a plexiglass cover. Submit the floor plan and it's location for approval to the Contracting Officer prior to installation.

Submit **Design Analysis and Calculations** for approval for the preaction and detection Systems consisting of the battery capacity and loading calculations in accordance with the paragraph entitled, "Preacton Control Panel."

#### 1.4 SYSTEM REQUIREMENTS

Preacton system must be a fully addressable, modular type, microprocessor based, supervised, non-coded electrical fire alarm system with **NFPA 72** Style D initiating device circuits, **NFPA 72** Style Z notification appliance circuits, and **NFPA 72** Style 7 signaling line circuits. All styles of Class A initiating device, signaling line, notification appliance and control circuits must use diverse routing in accordance with **NFPA 72**. The outgoing and return redundant circuit conductors must not be run in the same cable assembly, enclosure or raceway. System must be electrically connected to report alarms, silent alarms, troubles, and supervisory signals to the Central Fire Monitoring System; sound the general alarm continuously; and control auxiliary equipment such as smoke fire dampers, air handling units, magnetic door latches, etc., upon operation of one or more initiating devices. Initiating, notification, signal, and auxiliary control circuits must be 24 Vdc.

System must conform to all the applicable requirements of **NFPA 70**, **NFPA 72**, **NFPA 75**, **NFPA 90A**, and **NFPA 101**.

Preacton systems must contain all of the equipment, devices, programming and circuits required for system operation in accordance with NFPA Codes and KSC requirements, including remote reporting from existing Central Fire Monitoring System (CFMS) equipment.

Provide all additional equipment, cabinets, conduit, and labor to meet the requirements and intent of this specification.

Contract must provide a **list of parts and components** for the installed

system by manufacturer's name, part number, and nomenclature, and recommended stock level required for normal maintenance and unscheduled repairs.

Components installed under this contract can not be more than one (1) year older than the date of installation.

#### 1.5 [QUALITY ASSURANCE](#)

Equipment to be provided under this specification must be that manufactured preaction equipment which meets the requirements of the section entitled, "System Requirements." It must be the latest standard design, and must be listed by Underwriters' Laboratories [UL Fire Prot Dir](#) or approved by Factory Mutual and be suitable for it's intended service. All devices installed must function with the control panel and not interfere with the operation of the control panel.

#### 1.6 [SERVICES OF A CERTIFIED FIRE ALARM SPECIALIST](#)

Services of a Certified Specialist thoroughly experienced in fire detection and alarm work must be provided on site to perform or directly supervise the installation, make all necessary adjustments and perform all tests on the preaction system at the site.

Preaction specialist must be considered certified when the specialist holds a valid Fire Alarm System, Level III Certification from the National Institute for Certification in Engineering Technologies [NICET 1016-2](#) or a valid Level III Fire Alarm Engineering Technician Certification from the International Municipal Signal Association (IMSA), or is licensed by the State of Florida as a Fire Alarm Contractor I in accordance with Florida State Statute, Chapter 489, Part II.

Certification of other recognized agencies with equivalent requirements are also considered. [Evidence of the Contractor's State Certification](#) and the basis of certification must be provided to the Contracting Officer and be approved by the Contracting Officer, prior to any work being performed at Kennedy Space Center.

### PART 2 [PRODUCTS](#)

#### 2.1 [PREACTION CONTROL PANEL](#)

Preaction control panel (PCP) must contain power-on, alarm, supervisory, and trouble indicating lights plainly visible when the cabinet is closed. It must also contain the following functions and must be accessible only by unlocking and opening the unit:

- Alarm Silence
- Trouble Silence\
- Supervisory Silence
- Power On-Off (If standard by the manufacturer)
- Alarm/Trouble Acknowledge
- Auxiliary Devices (AHU shutdown relay) Maintenance By-pass Switches
- System Reset

Preaction control panel must contain all components necessary to monitor and supervise all initiating device circuits. When any detector, manual alarm station (pull box), water flow switch, pressure switch, etc., connected to the preaction control panel is activated, the control panels

visual alarm indication and audible signal must be activated. This must cause all notification appliances to be activated, including all associated auxiliary control functions. The control panel must visually indicate the addressable device or zone in alarm and transmit an alarm condition to the remote Central Fire Monitoring System. Separate audible and visual notification appliance circuits. Audible and visual notification appliance circuits must have sufficient capacity to operate all devices connected, plus 25 percent minimum spare capacity. Visual notification appliances must remain operational until the PCP has been reset.

Preaction control panel must contain all components necessary to monitor and supervise all supervisory device circuits. When any valve tamper switch, pressure switch, or other supervisory device connected to the control panel is activated, the control panel supervisory visual indication and supervisory audible device must be activated. The control panel must visually indicate the addressable device or zone in supervisory alarm and transmit a supervisory condition to the remote Central Fire Monitoring System.

Preaction control panel must contain all components necessary to operate and supervise the circuits for annunciator panels indicated and auxiliary devices controlling equipment such as ventilating fans, air handling units, fan coil units, damper motors, solenoids, magnetic door holders, etc. Circuits for auxiliary control relays must be supervised to within 914 millimeter 3 feet of the device to be controlled in accordance with NFPA 101. Preaction control panel must include a maintenance by-pass switch for all auxiliary control devices. By-pass switches must be supervised to report trouble when in the maintenance by-pass position.

Panel must monitor and report as trouble, open supervised circuits, ground faulted supervised circuits, removal of detector or device, removal or failure of control panel module, maintenance by-pass switch activated, loss of primary power, power supply trouble, low battery voltage, loss of battery voltage, [preaction control panel enclosure open], and activation of the alarm silence switch. All trouble signals must be identified by initiating, notification appliance, auxiliary control, or signaling line device. Trouble signals must activate the control panel trouble visual indication and trouble audible devices, and send a trouble signal to the remote Central Fire Monitoring System.

Alarm/trouble reset switches must reset a cleared device in alarm or trouble. Alarm or trouble signals must not be self-restoring without activating the switch.

Alarm, supervisory, and trouble silence switches must silence the alarm and trouble audible's. Either switch placed in other than the normal position must provide the following:

- a. Report as an alarm, supervisory, or a trouble to the Central Fire Monitoring System.
- b. Transfer audible signal to a panel lamp visual indication.
- c. Re-ring the trouble audible if the problem has been cleared, but the switch has been left in the silence position.

When the alarm silencing switches are in the silence position, subsequent alarms must reactivate the notification appliances. The strobes must remain operational until the preaction control panel is reset.

Preaction control panel must be suitable for use with the detectors and manual alarm stations, and other preaction devices specified in this section.

Preaction control panel must have a normally closed set of dry contacts single pole, double throw (SPDT) which opens for trouble conditions and a normally open set of dry contacts single pole, double throw (SPDT), which closes under alarm conditions for connection to the Central Fire Monitoring System.

All relays must be continuous duty and have self-cleaning contacts of silver or an alloy of equivalent performance. Supervisory relays must be suitably protected against dust by individual covers. All relays that provide external functions, such as remote reporting, control device activation, notification appliance activation must have at least one set of spare contacts. Permanently mark relays with the coil resistance, operating-current range, and internal pin connections using standard pin numbers.

[Install a separate terminal cabinet adjacent to the preaction control panel for interfacing device field wiring to the control panel. Install terminal strips for all field wiring circuits plus 25 percent spare. Where a terminal cabinet is installed, install terminal strips to accommodate remote reporting circuits.]

Preaction control panel, terminal cabinets and battery cabinets (when used) must be steel, provided with a hinged cover and an integral pin-tumbler cylinder lock (Lock Cylinder No. Best Universal Lock Co. No. A8817-XUS26D-7KSC) with removable core that accepts the key presently in use with other control units existing in the area; lock core is provided by the government. Cabinets must be painted with a prime coat and one or more finish coats of scratch-resistant baked enamel. Finish coat must be red unless otherwise indicated. An etched metal or engraved laminated plastic identification plate labeled, "preaction Control Cabinet," must be permanently affixed to the cabinet door of the preaction control unit to identify the cabinet as a preaction control system cabinet. For cabinets painted red the identification plate must have white letters on a black background. For cabinets not painted red the identification plate must have white letters on a red background.

System must operate from a power supply with 120 grounded Vac input and 24 Vdc output. System must operate satisfactorily with power input voltage varying from 85 to 110 percent of nominal value. Power supply output must be capable of powering all initiation, signaling, annunciation, and control devices during alarm condition with 25 percent minimum spare capacity. [If supplied within the cabinet, the power on-off switch must disconnect all power sources to the control panel. The on-off switch must have DC rated contacts.]

Batteries, charger, and power transfer equipment must provide the means of automatically supplying the entire preaction system with battery backup power in event of a primary power system failure. System must switch to battery power in event of AC power failure and switch back to AC power upon return of primary power. Control panel must be able to operate when the backup batteries are disconnected for any reason. System must control charging currents and floating voltage levels to maintain batteries in optimum condition. Provide capability to recharge batteries in event of discharge. Fuse wiring to protect against battery over-current and

polarity reversal. Primary power, battery, or charging equipment failure must result in a preaction control panel trouble signal and visual indication.

Battery modules must be sealed (no corrosive fumes) and spill-proof. Batteries must be listed for preaction service and must be suitable for high discharge currents required under alarm conditions. Batteries must be sized to operate the preaction and detection system (including voice evacuation systems and UV/IR flame detectors) in normal supervisory condition for 24 [48] [72] hours, minimum, then operate the system in the alarm mode for [5] 10 [15] minutes, minimum.

\*\*\*\*\*  
NOTE: Edit the following paragraph for a pre-action control panel to be used in facilities which do not require voice evacuation systems. Fill in the blanks for the number of zones to fulfill the job requirements and the maximum number of zones anticipated.  
\*\*\*\*\*

#### 2.1.1.1 Small Capacity PCP

\*\*\*\*\*  
NOTE: Edit the following paragraph for a pre-action control panel to be used in small facilities or suppression systems with 6 zones or less, and 2 CFMS reporting zone. Each automatic sprinkler system flow switch must report as a separate device. Fill in the blanks for the number of zones to fulfill the job requirements and the maximum number of zones anticipated.  
\*\*\*\*\*

Unit must be comprised of [\_\_\_\_\_] active zones, expandable to 6 zones via plug-in modules. It must have the required number of active zones to perform as indicated and specified herein. Auxiliary function/control devices must be added as required. Panel must include all equipment required for connection to the existing Central Fire Monitoring System.

#### 2.1.1.2 Medium Capacity PCP (Without Voice)

\*\*\*\*\*  
NOTE: Edit the following for a pre-action control panel to be used in facilities which do not required voice evacuation systems. Fill in the blanks for the number of zones to fulfill the job requirements and the maximum number of zones anticipated.  
\*\*\*\*\*

Unit must be a fully addressable system, comprised of [\_\_\_\_\_] addressable devices, [2] [\_\_\_\_\_] notification appliance circuits, and [4] [\_\_\_\_\_] supervised circuits for auxiliary control relays. Unit must be expandable to 8 [\_\_\_\_\_] notification appliance circuits. Construction must be modular, solid-state microprocessor based electronics. All modules must be equipped with transient suppression. System must include non-volatile programmable operating system memory for all operating requirements. Panel must include all equipment required for connection to the existing Central Fire Monitoring System.

Preaction control panel must include all components and modules required for installation of a multiple addressable device network. Network must utilize polling methods and provide two-way Style 6 supervised communications between the preaction control panel and addressable smoke detectors and monitor, signal, or control addressable modules.

### 2.1.3 Large Capacity Pre-Action Control Panel (With Voice)

\*\*\*\*\*  
**NOTE: Select and edit the following paragraphs for a pre-action control panel to be used in a large size facility or facility requiring addressable device, voice evacuation, or fire fighters telephone.**  
\*\*\*\*\*

Unit must be fully addressable system with [\_\_\_\_\_] addressable points to include addressable monitoring modules, voice evacuation system, fire fighters phone system, addressable input/output relays and supervised circuits to remote auxiliary control relays. Construction must be modular with solid-state, microprocessor based electronics. Modules must be equipped with transient suppression. System must include non-volatile programmable operating system memory for all operating requirements. Panel must include all equipment required for connection to the existing Central Fire Monitoring System.

Unit must include all components and modules required for a local facility maintenance and fire fighters phone system. Install a master telephone set at the control panel with remote phone jacks installed in the facility, as indicated on the contract drawings.

Preaction control panels voice evacuation system must include all components and modules required for a [single] [multiple] channel audio signaling system distributed over [8] [\_\_\_\_\_] audio signaling device circuits. Audio system must be capable of accurately reproducing bell tones and pre-programmed voice messages for [staged] building evacuation. Audio amplifier input must include a dedicated power supply with a primary power input of 120 V(AC) and a battery backup input of 24 V(DC). Audio amplifier output must be a minimum of 100 watts at 25 V(RMS), with a minimum 25 percent spare capacity provided. Locate a microphone and 4 inch speaker at the control panel for fire fighter paging and monitoring. Audio system control must include switching with visual indication for localized facility-wide paging announcements. Messages must be multi-lingual voice in five (5) languages, followed by temporal three (3) bell tone until silenced. The languages in priority are English, Spanish, French, Japanese, and Russian. The languages must be approved by the Contracting Officer.

Unit must include all components and modules required for installation of a multiple addressable device network. Network must utilize polling methods and provide two-way Style 6 supervised communications between the preaction control panel and addressable smoke detectors and monitor, signal, or control addressable modules.

## 2.2 CFMS REPORTING EQUIPMENT

### 2.2.1 Small/Medium Capacity PCP Reporting

\*\*\*\*\*

**NOTE: Edit this paragraph as required for systems of 6 reporting zones or less, without Simplex Model 2120 compatible communications equipment.**

**A Simplex Model 4100 system is installed at the VABR and CD&SC for monitoring of small systems in the LC-39 or Industrial Area respectively.**

\*\*\*\*\*

Preaction control panel must report to the Central Fire Monitoring System using the existing Simplex Model 4100 system, located at the [VABR] [LCC1P11] [CD&SC]. Reporting circuit must be 2-wire, Style B circuit from the indicated Simplex Model 4100 system zone module to the preaction control panel alarm relay and trouble relay, via base outside cable plant. A 3.3K ohm, 0.5 watt End-of-Line resistor is required at the PCP.

[Preaction control panel must report to the Central Fire Monitoring System using the existing Digitize Model 3000 system located in Building XY which is connected to the Remote Monitor Terminals located in Building 49750 (Alternate Central Security Building) and the redundant unit located in Building 1708 (Hangar R&D).]

[Reporting circuit must be a 2 wire, Style 6 circuit from Building XY to preaction control panel alarm relay and trouble relay via base outside cable plant. A 15 K ohm, End-of-Line resistor is required at the PCP.]

#### 2.2.2 Large Capacity PCP Reporting

\*\*\*\*\*

**NOTE: Edit these paragraphs as required for systems installed with Simplex or Siemens network communications interface equipment.**

\*\*\*\*\*

Provide network communication interface which must permit individual remote reporting of monitor devices and remote control of the preaction control panel from the Central Fire Monitoring System.

#### 2.2.3 Color Graphic Screens for CFMS Reporting System

Update programs for new or modified fire alarm control systems color graphic screens must be provided and installed in the existing Central Fire Monitoring System [Siemens] [Simplex] multiplexing system by original equipment manufacturer. All modifications and programming changes must be approved by the Contracting Officer, prior to installation.

#### 2.3 ADDRESSABLE MODULES/DEVICES

\*\*\*\*\*

**NOTE: Select and edit paragraphs as necessary for the multiplex system designs only.**

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Addressable modules must be solid state compatible with the preaction control panel. Modules must be suitable for individual outlet box mounting or group mounting within a control enclosure. Modules installed outdoors must be installed in weatherproof enclosures with a neoprene gasket and must be protected from corrosion.

Modules must be field addressable to individually communicate with the preaction control panel using multiplexed communication techniques. Communication circuit wiring connections must be suitable for supervised Style 6 operation. Module power must be derived from the communication circuit or 24 V(DC) power supply supervised by the preaction control panel. Invalid address setting, component failure, or power failure must initiate a trouble signal at the preaction control panel.

Enclosures must be painted with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, and durable finish. Enclosures must include an engraved phenolic nameplate labeled, "PREACTION MODULES."

Addressable modules for initiation circuits must be supervised 4-wire Style D type unless otherwise indicated. Addressable modules for notification appliance circuits must be supervised parallel wired Style Z type unless otherwise indicated. Module must be suitable for use with bells, strobes, and relays. Addressable modules for control circuits must include 2 separate fused Form-C contacts rated 2 Amperes at 28 V(DC) at 120 Vac.

## 2.4 ANNUNCIATOR PANELS

Annunciator panels must be [LED] [Front lighted] [Back lighted] [LCD Alphanumeric] type, compatible with and supervised from the preaction control panel. Operating power supply must be 24 V(DC). Lamp color must be yellow for trouble and red for alarm; provide a test switch for testing all lamps. Each lamp must have a nameplate with function identified for all lamps. Nameplate must be engraved phenolic tag.

[Annunciator panel must include an audible trouble/alarm buzzer with keyed silence switch.]

Provide LED type graphic annunciator panels where indicated. Annunciator must include laminated area display to indicate location and condition (trouble and alarm) of devices connected.

Terminal strips suitable for No. 18 through No. 14 AWG solid copper conductors must be provided for all annunciator panel wiring connections.

Mount annunciator panels in manufacturer required enclosures. Where hinged enclosures are used, provide a lock-set matching that of the preaction control panel. All exposed metal parts of annunciator panels must be painted with a prime coat and one or more finish coats of scratch-resistant baked enamel. Finish coat must be red unless otherwise indicated.

## 2.5 HEAT-ACTUATED DETECTORS

Heat-actuated detectors must be alarm-initiating devices designed for use with automatic/manual preaction systems, in accordance with [UL 521](#).

Heat-actuated detectors must be rated [136][190] degrees F fixed temperature with 15 degree F per minute rate-of-rise feature. Detectors must be self-restorable for the rate-of-rise feature and non-restorable for the fixed temperature feature. Detectors must have a rate-of-rise principle of operation, which uses an air chamber, a vent and a flexible metal diaphragm. The fixed temperature principle of operation must be by a fusible solder joint.

Detectors must have a set of normally open contacts that close to initiate an alarm. Wiring connections must be suitable for supervised Style D



operation, and must be made with terminal blocks capable of accepting No. 18 through No. 14 AWG solid copper conductors. All components of the detectors must be rust and corrosion resistant.

Locate detectors no closer than 300 millimeter 12 inches from any part of the lighting fixture and no closer than 600 millimeter 24 inches from any supply or return diffuser. Detectors installed in areas subject to moisture or exterior atmospheric conditions must be UL listed or FM approved for such locations.

Locate electronic heat detectors no closer than 1829 millimeter 6 feet from a fluorescent light fixture. Locate detectors no closer than 914 millimeter 3 feet from any return air diffuser and no closer than 1829 millimeter 6 feet from any supply diffuser. Detectors installed in areas subject to moisture or exterior atmospheric conditions must be UL listed or FM approved for such locations.

#### 2.5.1 Line-Type Fixed Temperature Heat Detector

Provide [thermostatic] or [thermistor] line-type heat detection cable [with weather-resistant outer covering] where indicated. Cable must be nominally rated for a temperature of [ 68 degrees C 155 degrees F] [ 88 degrees C 190 degrees F] [ 138 degrees C 280 degrees F] and must operate on fixed temperature principle only.

#### 2.5.2 Rate Compensating Heat Detector

Detectors must be hermetically sealed and automatically resetting type which operate when ambient air temperature reaches detector setting, regardless of rate of temperature rise. Detector operation must not be subject to thermal lag.

### 2.6 SMOKE DETECTORS

Smoke detectors must be alarm-initiating devices designed for use with automatic/manual preaction systems, in accordance with UL 268.

Smoke detectors must be [2.5] [\_\_\_\_\_] percent per foot nominal obscuration (photo-electric) type. Detector must be listed for use with preaction control panel installed, and must include all required accessories. Detectors and accessories provided must be rust and corrosion resistant. Detector head must be a plug-in unit. Unit must contain no moving parts, nor must it require re-adjustment or removal to resume normal operation after an alarm. Screen all detector openings to prevent the entry of insects and debris.

Detector base must include screw terminals suitable for No. 18 through No. 14 AWG solid copper conductors for all wiring connections required. Detector must be supervised to initiate a trouble signal at the preaction control panel if the detector is removed. A light emitting diode indicator must provide a visual indication when the detector initiates an alarm.

Locate detectors no closer than 1829 millimeter 6 feet from a florescent light fixture. Locate detectors no closer than 914 millimeter 3 feet from any return air diffuser and no closer than 1829 millimeter 6 feet from any supply diffuser. Detectors installed in areas subject to moisture or exterior atmospheric conditions must be UL listed or FM approved for such locations.

Provide remote annunciator in locations readily visible and accessible for detectors installed under raised floors or other locations where the detector is concealed or not readily visible; or the detector must be of the addressable type. Annunciator panels must be in accordance with the paragraph entitled, "Annunciator Panels". Install remote test/light assemblies for installations that are not readily accessible. Where multiple duct smoke detectors are installed, group the remote test switches together at a common location.

\*\*\*\*\*  
**NOTE: Use the following paragraph where addressable  
smoke detectors are to be used in lieu of Remote  
Annunciator Panels.**  
\*\*\*\*\*

Provide addressable detector bases where indicated, or used in lieu of remote annunciator panels. Base must include circuitry and user selectable switching required for assigning each detector a unique address on the preaction control panel communication bus. Invalid address switch settings or component failure must initiate a trouble signal at the preaction control panel.

Detectors must be the 2-wire Style D type, powered from the panel alarm initiation or communication bus circuit; separate power sources are not acceptable.

#### 2.6.1 Duct Smoke Detectors

Duct smoke detectors must be alarm-initiating devices designed for use with automatic/manual preaction systems, in accordance with [UL 268A](#).

Duct smoke detectors must be photoelectric type listed by [UL Fire Prot Dir](#) or FM approval guide for duct smoke detector installation. Provide duct detectors with perforated sampling tubes extending across the width of the duct. Activation of duct smoke detectors must cause shutdown of the associated air handling unit, annunciation at the preaction control panel, and transmit a silent alarm to the Central Fire Monitoring Station, but must not activate the building evacuation notification appliances. Duct smoke detectors must be addressable type connected to an addressable PCP, with ability to perform sensitivity testing in accordance with [NFPA 72](#). Provide a single maintenance by-pass switch to isolate each air handling units' duct smoke detectors. Activation of any maintenance by-pass switch must inhibit reporting and cause a trouble condition at the PCP. When the maintenance by-pass switch is restored to it's normal configuration, the trouble signal at the PCP must be self-restoring. Where duct smoke detectors are installed outdoors or in high ambient temperature areas, install the detector housing in an additional PVC enclosure with an additional set of supply and exhaust sampling tubes, to prevent condensation from forming within the detector housing.

Install a separate remote test/light assembly for each duct smoke detector. Where multiple duct smoke detectors are installed, group the remote test switches together at a common location.

#### 2.7 MANUAL ALARM STATIONS

Manual alarm stations must be non-coded, addressable type, alarm-initiating devices designed for use with automatic/manual preaction systems, in accordance with [UL 38](#).

Wiring terminals must be suitable for 2-wire, Style D wiring and must be capable of accepting No. 18 through No. 14 AWG solid copper conductors.

Manual alarm station door must have a protected, pulldown operating lever with finger grip which does not project out from the front of the case. When operated, the station must mechanically latch, break a glass or plastic rod, close one or more sets of contacts, and lock the contacts in the operated position until reset. Stations with a pushbutton which depends upon a spring-loaded device to close the contacts when the handle is pulled are not acceptable. Stations must not be resettable without the use of a key or tool.

All exposed metal surfaces of enclosing cases must be painted with a prime coat and one or more finish coats of red enamel to produce a smooth, hard, durable finish. Identification and directions for operating preaction stations must be provided on the cover in raised or depressed white-enameled letters. Manual alarm stations constructed of plastics or composite material are not acceptable.

Surface mounted stations must be furnished with matching cast-iron or cast-aluminum back boxes with top and bottom threaded-conduit connections. Stations mounted outdoors must be weatherproof with a neoprene gasket, and must be protected against corrosion.

## 2.8 ALARM BELLS

Preaction bells must be red, 250 millimeter 10 inches vibrating, under-dome, notification appliances in accordance with UL 464. Bell must produce at least 87 dB at 3000 millimeter 10 feet and must conform to NFPA 70.

Alarm bells must be solenoid-operated plunger sounding devices. Operating mechanism must be rustproof, protected from dust and insects, and located behind the gong shell.

Alarm bells must operate from polarized 24 Vdc preaction control panel Style Z parallel wired supervised notification appliance circuits. Wiring connection must be on terminal blocks suitable for 1.25 through 2 millimeter diameter (No. 16 through No. 12 AWG) No. 16 through No. 12 AWG solid copper conductors.

Strobe portion of combination audible/visual notification appliances must be in accordance with the applicable provisions of the paragraph entitled, "Strobe Units."

Surface-mounted alarm bells installed in unfinished areas with conduit exposed must be secured to surface-mounted back boxes. Back boxes must be cast iron or cast aluminum, with threaded conduit connections. All exposed metal surfaces must be painted with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, durable finish.

## 2.9 STROBE UNITS

Strobe units must be notification appliances designed for use with automatic/manual fire alarm systems, in accordance with UL 1971.

Strobe units must meet the requirements of the Americans with Disabilities Act (ADA) and must be constructed of red cast metal housing, clear

polycarbonate dome lens with red "FIRE" lettering on two sides , and a xenon flash tube with solid state circuitry. Unit brightness must be no less than 75 candela, producing approximately 80 to 90 flashes per minute. Unit must be UL listed or FM approved for fire protective service.

Unit must operate from polarized 24 Vdc preaction control panel Style Z parallel wired supervised notification appliance circuits. Multiple strobes visible from a single area must be synchronized. Operating current must not exceed 0.2 amperes, and unit must operate over a 20 percent variation in nominal input voltage. Wiring connection terminal blocks must be suitable for 1.25 through 2 millimeter diameter No. 16 through No. 12 AWG solid copper conductors.

Install flush mounted interior units using standard electrical backboxes. Install surface mounted units in cast iron or cast aluminum boxes with threaded conduit hubs.

All metal exposed surfaces must be painted with a prime coat and one or more finish coats of red enamel to provide a smooth, hard durable finish.

## 2.10 SPEAKERS

Speakers must be notification appliances designed for use with auto/manual preaction systems, in accordance with UL 1480 and UL 1711.

Notification appliance speakers must be UL listed or FM approved for audible signal use, and must be capable of clearly reproducing voice messages and bell tones over a 400 to 4000 Hz range. Speaker output at 1000 Hz for 1 Watt input power must be no less than 87 dB at 3000 millimeter 10 feet.

Notification appliance must consist of sealed speaker and multiple-tap impedance matching transformer suitable for 25 Vdc Style Z parallel wired supervised audio signaling systems. Transformer settings must include 0.25, 0.5, 1.0, and 2.0 Watt taps unless otherwise indicated. Wiring connections for 4 wire operation must be screw terminals suitable for 1.25 through 2 millimeter diameter No. 16 through No. 12 AWG conductors.

Speakers housings must be of red impact resistant polycarbonate or cast metal construction. Mount flush mounted interior speakers using standard electrical backboxes. Mount surface mounted speakers using red cast iron or cast aluminum boxes with threaded conduit hubs. Speakers mounted in exterior or wet locations must be weather-proof with a neoprene gasket and must be protected from corrosion. All metal exposed surfaces must be painted with a prime coat and one or more finish coats of red enamel paint to provide a smooth, hard, durable finish.

Strobe portion of combination audible/visual notification appliances must be in accordance with the applicable provisions of the paragraph entitled, "Strobe Units."

## 2.11 WATER FLOW ALARM DEVICES

Water flow alarm devices must be alarm initiating devices designed for use with automatic/manual preaction systems, in accordance with UL 346.

Water flow alarm devices must conform to UL or FM requirements for the particular type of sprinkler system. Contacts must have a minimum of 2 single pole, double throw contacts rated 5 amps at 28 V(DC) or 250 V(AC).

### 2.11.1 Pressure Switch

Pressure switch alarm must be wired to make or break an alarm circuit depending on rise or fall of water pressure. Switch must have an instant-recycle pneumatic-retard, or electronic adjustable setting time delay.

### 2.12 VALVE TAMPER SWITCHES

Valve tamper switches must be supervisory-initiating devices designed for use with automatic/manual preaction systems, in accordance with [UL 346](#).

Valve tamper switches must conform to UL or FM requirements for use on the specified valve. Contacts must have a minimum of 2 single pole, double throw contacts rated 5 amps at 28 Vdc or 250 Vac.

Valve tamper switches installed in hazardous locations must be UL listed or FM approved for the hazardous location classification indicated. If the beacon is not factory sealed, conduit seal-off fittings suitable for the hazardous location must be installed at each conduit connection to the explosion-proof enclosure, in accordance with [NFPA 70](#).

### 2.13 REMOTE AUXILIARY CONTROL RELAYS

Remote control relays must have continuous duty coils rated 24 Vdc. Where relays are used on Style Z parallel wired supervised circuits, coils must incorporate supervisory current blocking diode. Relays must have a minimum of two (2) single pole, double throw contacts rated 10 amps at 28 Vdc or 250 Vac. Where auxiliary control circuits connected to the relay are protected at a higher ampacity than the relay contacts are rated, fusing rated to protect the relay contacts must be installed in the relay enclosure.

Remote auxiliary control relays must be mounted in enclosures indicated or, if not indicated, in manufacturer's required enclosure. Relays installed outdoors must be installed in a weatherproof enclosure with a neoprene gasket and must be protected against corrosion.

Paint enclosure with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, and durable finish. Label enclosure with an engraved phenolic nameplate labeled, "F/A RELAY."

Remote auxiliary control relays must be mounted and supervised within [914 millimeter 3 feet](#) of the controlled device in accordance with [NFPA 101](#).

### 2.14 POWER SOURCES

Normal power to the local systems for all purposes, including separate powered indicating/alarm devices, must be 120 volts 60 hertz. System must operate satisfactorily between 85 and 110 percent of normal voltage. Preaction system disconnect/protective device must be a fused switch with a red factory finish as specified herein for manual alarm stations. Mount this disconnect switch adjacent to the fire alarm control panel. In addition, mark it PREACTION CONTROL PANEL DISCONNECT with [12 millimeter 1/2-inch](#) high letters in white paint or engraved phenolic identification plates fastened with sheetmetal screws. Switch must be capable of being locked in the "on" or "off" position. This feature must not interfere with the circuit protection capability of the device. Switch must be equipped

with surge suppression for all phase and neutral conductors. Install current limiting Class RK1 fuses properly sized to protect the preaction control panel components.

## 2.15 WIRING

Provide wiring in accordance with NFPA 70 and NFPA 72. Conductors must be copper. Conductors for 120 V(AC) circuits must be No. 12 AWG minimum.

Conductors installed on fire alarm systems must be solid copper with an insulation rating of not less than 300 volts. Mark conductors with the size, voltage rating and manufacturer's name permanently marked on the conductor jacket at no less than 610 millimeter 2 feet intervals. Conductor size and color are listed below. Where modifications are made to existing systems, the new or added conductors must match the size and color-coding of the existing system.

Conductors for multiplexed communication circuits, signaling line circuits, speaker audio circuits, remote phone circuits, and remote reporting circuits must be solid copper, shielded, twisted pairs meeting UL 2196. Cable must be listed as Type FPL, Power-Limited Fire Protective Signaling Cable. Conductor size must be not less than No. 16 AWG diameter. Conductor insulation must be Type TFN for No. 16 AWG diameter and Type THHN/THWN for No. 14 AWG diameter and larger.

Direct current initiating device (manual pull station) circuits must be a two loop circuit per NFPA 72, Style D. Conductor size must not be less than No. 16 AWG diameter. Conductor insulation must be Type TFN for No. 16 AWG diameter, and Type THHN/THWN for No. 14 AWG diameter and larger.

Power leads from the control panel for product-of-combustion detectors must be sized accordingly, but not less than No. 14 AWG diameter. Conductor insulation must be Type THHN/THWN for No. 14 AWG diameter and larger.

Direct current notification appliance circuits (strobes, bells) must be parallel wired per NFPA 72, Style Z. Conductor size must be not less than No. 14 AWG diameter. Conductor insulation must be Type THHN/THWN for No. 14 AWG diameter and larger.

Direct current auxiliary control device (AHU shut down relay) circuits must be parallel wired per NFPA 72, Style Z. Conductor size must not be less than No. 14 AWG diameter. Conductor insulation must be Type THHN/THWN for No. 14 AWG diameter and larger.

Preaction solenoid valve control circuits must be NFPA 72, Style Y. Conductor size must not be less than 1.6 millimeter No. 14 AWG diameter. Conductor insulation must be Type THHN/THWN for 1.6 millimeter No. 14 AWG diameter and larger.

### 2.15.1 Fire Resistive Cables

Fire resistive cables must be for notification appliance circuits designed for use with automatic/manual fire alarm systems in accordance with UL 2196.

Provide UL Fire Prot Dir listed Type FPL-CI fire alarm cable for use with power limited fire alarm notification appliance circuits. The CI cable must have a minimum 2 hour fire resistance rating by having passed the applicable testing requirements of UL 2196. Install this cable in locations required to meet NFPA 72 survivability requirements.

## 2.16 SURGE SUPPRESSION

Provide line voltage and low voltage surge suppression devices to suppress all voltage transients which might damage the control panel components.

Surge suppression in accordance with [UL 497B](#) must be installed on each conductor of preaction circuits which extend beyond a building. Locate protection as close as practical to the point where the circuits leave the building. Install protectors in enclosures of adequate size, with terminal strips for all wiring connections plus 25 percent spare. Enclosures must be painted with a prime coat and one or more coats of red baked enamel finish to provide a smooth, hard, and durable finish. Protectors must be connected to an earth ground electrode system, in accordance with the manufacturer's requirements and [NFPA 70](#).

### 2.16.1 Line Voltage Surge Suppressors

Suppressor must be [UL 1449](#) listed, with a maximum 330 volt clamping level and a maximum response time of 5 nanoseconds. Suppressor must also meet [IEEE C62.41](#), Category B tests for surge capacity. Suppressor must be a multi-stage construction which includes inductors and silicon avalanche zener diodes. Suppressor must have a long-life indicating lamp (light emitting diode or neon lamp), which extinguishes upon failure of protection components. Fuses must be externally accessible. Wire in series with the incoming power source to the protected equipment using screw terminations.

### 2.16.2 Low Voltage Surge Suppressors

Provide for all circuits which leave the building shell and as shown on the contract drawings. When circuits interconnect two or more buildings, provide an arrester at the circuit entrance to each building. Suppressor must be [UL 497B](#) listed, with a maximum 30 volt clamping level and a maximum response time of 5 nanoseconds. Suppressor must have multi-stage construction and both differential/common mode protection.

## PART 3 EXECUTION

### 3.1 SYSTEM SEQUENCE OF OPERATION

#### 3.1.1 Normal Operation

All switches must be in the normal position. Available power lamp must be on and the trouble and detector identification lamps must be off. All circuits must be electrically supervised.

#### 3.1.2 Supervisory Condition

System conditions identified in the paragraph entitled, "Fire Alarm Control Panel" must transmit a supervisory signal to the Central Fire Monitoring System, provide device indication, activate a supervisory signal in the fire alarm control panel, and provide input to remote annunciators (when used). Supervisory signal in the alarm control unit must be comprised of visual and audible indications. The supervisory signals must be self-restoring.

#### 3.1.3 Trouble Condition

System conditions identified in the paragraph entitled, "preaction Control

Panel," must transmit a supervisory signal to the remote reporting device of the Central Fire Monitoring System, provide zone indication, activate a trouble signal in the preaction control panel, and provide input to remote annunciators (when used). Trouble signal in the alarm-control unit must be comprised of visual and audible indications.

#### 3.1.4 Alarm Condition

Activation of any detectors, manual alarm stations, water flow switches, or other initiating devices must close a contact that activates the appropriate preaction control panel. Preaction control panel transmits a signal to the remote reporting device of the Central Fire Monitor System; activates the notification appliances; provides zone identification; controls air handling and ventilating units; provides an input to remote annunciators (when used); and provides indication or control to devices or other systems.

### 3.2 INSTALLATION

#### 3.2.1 Preaction Control Panel(s) and Reporting Equipment

Equipment must be installed in each protected building, located where indicated, and must be complete with all indicated accessories and devices. Install equipment in accessible locations in such a manner as to prevent damage from vibration or jarring. Equipment requires a minimum of 914 millimeter 3 feet clearance directly in front of the panel for maintenance per NFPA 70. With multiple equipment, the 914 millimeter 3 feet clearance is required directly in front of the complete configuration. In addition, provide a 711 millimeter 28 inch clear aisle way for access to the equipment.

Wiring within preaction control panel(s) and reporting equipment must be in accordance with the paragraph entitled, "Installation in Cabinets and Boxes."

Conductors in accordance with the paragraph entitled, "Wiring" must be installed from the [modem cabinet][code transmitter][preaction control panel] to a new [4][8] point terminal strip labeled "FATB" in the indicated telephone terminal cabinet.

When preaction control panels and reporting equipment are installed flush or semi-flush, three spare 25 millimeter 1-inch conduits in accordance with the paragraph entitled, "Conduit and Raceways," must be installed from the preaction control panel wiring termination cabinet to an accessible location.

#### 3.2.2 Addressable Modules and/or Devices

Install zone addressable modules at accessible locations indicated. Configure module address switches to settings indicated on approved shop submittals. Identify modules individually adjacent to their mounting.

Control zone addressable modules used for smoke control, AHU shutdown, etc. must be mounted in accessible locations within 914 millimeter 3 feet of the device to be controlled. Control modules connected to separately energized control wiring from auxiliary systems must not be installed in the same enclosure with initiation and signal zone addressable modules.

Where zone addressable modules are grouped within an enclosure, wiring must



be in accordance with the paragraph entitled, "Installation in Cabinets and Boxes."

#### 3.2.3 Annunciator Panels

Panels must be installed in accessible locations in such a manner as to prevent damage from vibration or jarring.

Annunciator panels must be installed in each protected building, located where indicated, and must be complete with all indicated accessories and devices. Install annunciator panels in accessible locations in such a manner as to prevent damage from vibration or jarring. Annunciator panels require a minimum of 914 millimeter 3 feet clearance directly in front of the panel for maintenance, per NFPA 70. With multiple panels, the 914 millimeter 3 feet clearance is required directly in front of the complete configuration. In addition, a 711 millimeter 28 inch clear aisle way must be provided for access to the annunciator panels.

Wiring within annunciator panels must be in accordance with the paragraph entitled, "Installation in Cabinets and Boxes".

#### 3.2.4 Heat-Actuated Detectors

Ceiling-mount detectors unless otherwise indicated. Location, number, and general arrangement to be as indicated. Field installation locations must comply with NFPA 72.

#### 3.2.5 Smoke Detectors

Smoke detector location, number, and general arrangement to be as indicated; field installation must be in accordance with NFPA 72. Detectors must not be installed until the work of other trades is complete.

Duct smoke detectors must be installed in accordance with the manufacturer's requirements and NFPA 90A. All duct penetrations must be sealed air- and water-tight.

Configure addressable smoke detector address switch settings as approved on shop drawings and submittals. Detectors must not be installed until work by other trades is completed.

#### 3.2.6 Manual Alarm Stations

Mount manual pull stations at locations indicated, within 457 meter 48 inches of the latch side of the door. Mounting height must be 48 inches above the finished floor, measured from the top of the device.

#### 3.2.7 Alarm Bells/Speakers

Mount bells and/or audio speaker notification appliances at the approximate locations indicated. Mounting height must be 90 inches above the finished floor, measured from the top of the bell/speaker, but no less than 152 millimeter 6 inches below the ceiling.

#### 3.2.8 Strobe Units/Combination Audio/Visual

Mount strobe light notification appliances at the approximate locations indicated. Locations must be unobstructed and allow viewing by area occupants in accordance with NFPA 72. Mounting height must be 2032

millimeter 80 inches above the finished floor, measured from the bottom of the strobe, but no less than 152 millimeter 6 inches below the ceiling.

### 3.2.9 Auxiliary Control Relays

Remote control relays must be installed and supervised in accessible locations within 914 millimeter 3 feet of the device to be controlled.

### 3.2.10 Wiring

Wiring must conform to the requirements of NFPA 70 and the following special requirements:

Install preaction system circuits in a separate raceway system. Each circuit type (Initiating, Notification, Signaling, and Control) must be routed through a dedicated separate conduit or raceway system configured to comply with NFPA 72 Class "A" conduit system requirements. 60-hertz power circuits must not enter enclosures containing preaction circuits, except where required to connect to the preaction system.

Conductors must be continuous from a terminal point at one device to a terminal point at the next device to the preaction control panel. Break wires at each terminal; wires must not be looped over a terminal. Install solderless ring tongue terminal lugs with manufacturer's required tooling on the device wiring connection leads. Use this ring type lug on stranded wire only. Make termination of solid wire on compression or screw type terminals. When screw type terminals are used the conductor must be captured under 80 percent of the screw head surface.

Conductor colors are listed below and must be in accordance with FED-STD-595. Where modifications are made to existing systems, the new or added conductors must match the size and color coding of the existing system.

Conductors for multiplexed communication circuits, speaker audio circuits, remote phone circuits, and remote station signaling circuits must be marked with circuit designation and consistent color coding for the positive and negative loops must be maintained throughout the cable system.

Direct current initiating device circuits (heat detectors, manual pull station) must be a two loop circuit per NFPA 72, Style D with the positive loop conductor colored blue, Color No. 15102, and the negative loop conductor colored black, Color No. 17038.

Power leads from the control panel for product-of-combustion detectors must be one white, Color No. 17877 positive, and one black, Color No. 17038 negative.

Direct current notification appliance circuits (bells, strobes) must be parallel wired per NFPA 72, Style Z. Positive conductor must be colored red, Color No. 11105, and the negative conductor must be colored orange, Color No. 12473.

Direct current auxiliary control device circuits (AHU shutdown relay) must be parallel wired per NFPA 72, Style Z. Positive conductor must be colored yellow, Color No. 13591, and the

negative conductor must be colored brown, Color No. 10055.

The solenoid valve safing key switch must be a Best Lock, Model 1W702-S4D, which opens both the positive and negative conductors. Solenoid positive conductors must be color-coded yellow, negative conductors must be violet. Wiring must comply with standard KSC solenoid valve wiring standards.

#### 3.2.10.1 60-Hertz Power

60-hertz power to the preaction control panel or separately powered devices must be 120 volts. There must be one black phase conductor, one white or grey solidly grounded neutral conductor and one green equipment grounding conductor. Conductor size must be as shown on the drawing with the minimum size 2 millimeter diameter (No. 12 AWG) No. 12 AWG copper. Install surge arrestors in accordance with NFPA 72 and NFPA 70.

#### 3.2.10.2 Installation in Cabinets and Boxes

Wiring in control cabinets and boxes must be installed in a neat and orderly manner with wire properly grouped, tie-wrapped, or laced parallel and perpendicular to the major axis, supported and identified. Control wiring must be continuous from device to device with no splices unless otherwise indicated. All wires entering or leaving control cabinets, boxes, and devices must be permanently marked and terminated on screw terminals. Marking must be consistent throughout the preaction system and must be the same as the identification shown on the connection drawings.

#### 3.2.11 Conduit and Raceways

Minimum size for preaction system initiating, alarm and control circuit conduit and raceways must be [ 13 millimeter 1/2 inch] 19 millimeter. 3/4-inch Installation must be in accordance with NFPA 70.

Rigid galvanized heavywall steel conduit must be installed in all hazardous (classified) locations, exterior above grade and interior exposed, unless otherwise shown on the drawings. EMT with hexnut expansion gland-type fittings is allowed to be installed in all other areas. Use flexible metal raceway, maximum length 1829 millimeter 6 feet, as the final connecting raceway to a preaction system device mounted on vibrating equipment or on a suspended ceiling.

Conduit direct buried in earth must be Schedule 80 PVC. Portions of underground raceway system that penetrate above finished grade must be rigid galvanized heavywall steel conduit with a 40 mil PVC coating or painted with a bitumastic compound.

Conduit in interior finished areas must be concealed. Conduit through fire-resistant rated walls, floors, ceilings, must be fire-stopped in a manner that maintains the fire-resistant rating of the wall, floor, or ceiling.

Conduit installed in a vertical position must be parallel with walls and perpendicular with the floor and ceiling. Conduit installed in a horizontal position must be parallel with the floor and ceiling and be perpendicular with the walls. Changes in direction of runs must be made with symmetrical bends. Bends of over 25 millimeter one inch in diameter must be factory made elbows.

Preaction solenoid valve control circuits must be NFPA 72, Style Y. Positive conductor must be colored yellow, and the negative conductor must be colored violet.

#### 3.2.12 Tamper Switches

Provide tamper switches for all fire protection control valves where closure of the valve impairs service. In addition, provide tamper switches for valves that supervise system conditions where closure or opening of the valve impairs the supervisory function.

### 3.3 FIELD TESTING

After complete installation of the equipment and at such time as directed by the Contracting Officer, conduct tests to demonstrate that the installation requirements of this specification have been met and that the sequential functions of the system comply with the requirements specified herein. Tests covered in the following paragraphs must be done in two parts:

- a. Preliminary - This must be an "in house" test to verify all the systems and components. Perform this functional test in the presence of government inspectors and repeat until one full test can be performed without device or system malfunction.
- b. Final Acceptance - After the successful completion of the preliminary testing, the systems must be fully tested formally with full documentation (including As-Built Drawings) using the previously approved recording form. Contracting Officer must witness this test and final acceptance of the system is based upon his written approval of the test.

On both preliminary and final tests, follow the approved testing procedures.

#### 3.3.1 External System Wiring

Perform the following tests on the external system wiring before connection to the control panel:

Continuity of circuits must be checked with an ohmmeter. Insert temporary jumpers in appropriate sockets of missing detectors and install the end-of line resistor when this test is performed. Resistance reading for each circuit must be the value of the end-of-line resistor, plus or minus 10 percent.

Each wire must be checked for grounds with a 500-volt insulation resistance test set. Resistance to ground must not be less than 20 megohms.

#### 3.3.2 Preaction System Acceptance Tests

After completion of the above tests, connect the external system wires to the appropriate terminals in the control panel and perform the following tests:

With the control panel energized, demonstrate the proper operation of all indicating lights and alarms.

Demonstrate each annunciator panel lamp to operate when it's associated

device or zone is activated.

Activate each manual alarm station to demonstrate proper operation.

Activate each smoke detector in accordance with the manufacturer's instructions, to demonstrate proper operations; both alarm and trouble.

Each duct smoke detector must have a static pressure differential test performed to verify that the pressure differential between the inlet and outlet tubes is within the manufacturer's specifications for acceptable operation.

Each time an initiating or supervisory circuit is activated, verified that the associated device address, notification appliance circuits, auxiliary control circuits, and alarm reporting to the Central Fire Monitoring System is activated and the correct information is displayed by the color graphics units.

One lead at each alarm initiating device, (manual pull station, smoke detector, flame detector, heat actuated detector, etc.), must be removed and grounded to demonstrate circuit trouble, ground fault, and then alarm over ground fault with an open circuit.

Turn off power to each separately powered panel or device to simulate loss of power and to demonstrate operation of the trouble alarm.

Test the rate-of-rise, (fixed temperature line-type) function on each heat-actuated detector in each zone, by application of heat from a heat lamp or hand held hot air blower. These detectors must initiate an alarm to the system. Detectors must sustain repeated tests of the rate-of-rise function without damage to the fixed temperature function. Replace heat-activated detectors (HADS) subject to operation from body temperature.

Open and close water suppression system valves requiring tamper switches, to demonstrate proper operation.

Activate pressure switches by water flow at the inspectors test valve to demonstrate proper operation.

Demonstrate each alarm initiating circuit to operate its associated alarm-control and auxiliary control units and remote reporting.

Remove and ground one lead at each notification appliance and auxiliary control device to demonstrate open circuit trouble, ground fault trouble, and then operation over ground fault with an open circuit.

Demonstrate each alarm control unit to operate in all modes.

Demonstrate capacity and the operation of the battery backup system to operate as required by these specifications by disconnecting the 120 volt, 60 Hz power from the preaction (control) panel and operating the system as specified for backup operation.

All circuits interconnecting with other systems fire protection, smoke control, HVAC, security and safety, elevators, etc., must be demonstrated to operate as specified on alarm from the associated zone or zones.

Multiplex equipment, devices, and wiring must be tested in accordance with NFPA 70 and manufacturer's requirements.

### 3.3.3 Re-Acceptance System Tests

Perform re-acceptance testing after system components are added or deleted; after any modification, repair, or adjustment to system hardware or wiring; or after any change to software. All components, circuits, systems operations, or site specific software functions known to be affected by the change or identified by a means that indicates the system operational changes must be 100 percent tested. In addition, also test 10 percent of the initiating devices that are not directly affected by the change, and verify proper system operation.

Changes to all control units connected or controlled by the system executive software requires a 10 percent functional test of the system, including a test of at least one device on each input and output circuit to verify proper system operation.

Upon completion of the modifications, functionally test the existing devices that were reinstalled and test the devices that are on both sides of the point of connection of the new devices. All newly installed devices must be tested in accordance with the paragraph entitled, "Preaction System Acceptance Tests".

After final acceptance testing has been successfully completed, the Submit test data under the terms of the "GENERAL REQUIREMENTS" clause of this contract.

### 3.4 OPERATION AND MAINTENANCE MANUALS

Submit operation and maintenance manuals. Information bound in manual format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, procedures, recommended spare parts, recommended test equipment, and safety precautions. Submit this information prior to acceptance tests being performed.

### 3.5 PAINTING

Manufacturer's standard-finish equipment surfaces damaged during construction must be brought to as-new condition by touch-up or re-painting to the satisfaction of the Contracting Officer, or replaced with new undamaged equipment at an additional cost to the Government.

All fire alarm equipment and appurtenances must be painted red, color number 11105 in accordance with FED-STD-595.

-- End of Section --